Flora of the Territory Wildlife Park, Berry Springs, with particular reference to the grass layer

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Abstract

The Territory Wildlife Park near Darwin is often used as a study site for ecological research. As a consequence, a detailed discussion of vegetation in the grass layer is required by present and future researchers. This study presents a comprehensive species list of grass layer plants found within the Park, compiled from published and unpublished surveys in the period 1980 to 2004. Additionally, the current composition of the grass layer vegetation was compared with a description of the Park area undertaken in 1980. There are 242 grass layer plant species present, represented by 56 families and 145 genera. The number of species at the Territory Wildlife Park is much greater than in another popular experimental site nearby (Solar Village), although the proportion of the different life-form groups (e.g. grasses, forbs, vines) is generally similar. In at least the north-western area of the Park, the dominant grass layer species have changed. *Aristida* sp. and *Sarga intrans* have decreased in abundance in areas where they were dominant in 1980. The cause of this decline may be related to the Park's unusual fire and grazing history.

Introduction

The Territory Wildlife Park (TWP) in Berry Springs, 40 km south-west of Darwin, is often used as a study site for ecological research owing to its proximity to the Northern Territory capital. A survey of the vegetation within the Park was performed in 1980 (Sivertsen *et al.* 1980), although a detailed discussion of the grass layer (e.g. grasses, sedges, forbs, etc.) was not included. Twenty-six years after that survey and with the development of the Park, the composition of the grass layer appears to have changed in some areas. Current and prospective researchers could benefit from a detailed description of the grass layer. The composition of the grass layer within the north-western corner of the TWP is described here and compared with observations from the same area in 1980, to examine whether any changes have occurred in the last 26 years. Additionally, a comprehensive species list of grass layer plants is provided.

Methods

Vegetation structure and grass layer composition

The undeveloped north-western section of the TWP is dominated by a *Eucalyptus* tetrodonta/E. miniata open forest (sensu Specht et al. 1995). A small area in the vicinity of Goose Lagoon (c. 5-10 ha, Fig. 1a) has a higher density of mid-storey plants (hereafter referred to as the dense mid-storey community) than the area further to the north (c. 30 ha, Fig. 1b). Much of the ground in the dense mid-storey community is shaded and covered by leaf litter, resulting in low grass density and cover, and the presence of essentially only one grass species (*Eriachne triseta*) and very few forb species.

The vegetation further to the north has a lower density of mid-storey plants (hereafter the *sparse mid-storey* community) and supports a continuous and species rich layer of grasses and forbs. The grass species in this area are typically low-growing perennials such as *Eriachne triseta* and *E. avenacea* (20-60 cm), or annuals of intermediate height such as *Pseudopogonatherum contortum* (50-100 cm). *Alloteropsis semialata, Sarga plumosum*, and *Chrysopogon* spp. are relatively common taller grass species, growing up to 1.5 m. The exotic grasses *Andropogon gayanus* and *Pennisetum pedicellatum* are present throughout the TWP and adjacent rural properties, although *P. pedicellatum* is more abundant.



Figure 1. Open forest communities of the north-western corner of the Territory Wildlife Park. a) surrounding Goose Lagoon with a dense mid-storey of shrubs and b) further to the north, with a sparse mid-storey shrub layer.

There are differences in the composition of the grass layer between the north-western area of the TWP mentioned above and adjacent privately owned land to the west. Whilst the tree layer appears similar to that immediately inside the TWP, tall annual and perennial grasses such as *Sarga intrans* and *Heteropogon triticeus* are the dominant species in the adjacent privately owned land, yet only occur in low abundance within the Park.

A land resource survey of the TWP area provided a description of vegetation and several photographs (Sivertsen *et al.* 1980) and is used here to describe changes to the grass layer composition within the north-western corner since 1980.

Species list

A list of vascular plants found within the grass layer of the TWP is presented as a compilation of surveys undertaken by Sivertsen *et al.* (1980, 40 species contributed), Green Corps (2003, 155 species), the author's own records (82 species), and Schatz (unpubl., 15 species; Table 1). Species in the list contain superscripted letters to denote which species were contributed by the various authors. Species lists are presented in full by Sivertsen *et al.* (1980) and Green Corps (2003), while the author and Schatz (unpubl.) provide species detected during vegetation surveys.

The author used 648 permanent 1 m^2 quadrats throughout the site annually in the late wet season between 2004 and 2006, as part of a project surveying the abundance of grass layer species and their response to fire. Schatz (unpubl.) used the same quadrats, but surveyed in the late wet season on a single occasion in 2004. The plants in the author's list were identified by experienced field personnel or plant taxonomists. Voucher specimens in the author's collection and Schatz (unpubl.) are stored at the CSIRO Tropical Ecosystems Research Centre, Darwin. The authors of the remaining sources of data used to compile the species list have not lodged voucher specimens at a particular location, and as such the identification of their specimens should be treated with an element of caution.

Plants were included in the list if noted as forbs (FO), vines (VN), sedges (SE), grasses (G), ferns (F), or a combination of those life-forms (e.g. shrub/forb, SH/FO) by Brennan (1996). The few remaining species not listed by Brennan (1996) were assigned life-form classifications which are present in the literature or from photographs. Trees, shrubs, epiphytes, hydrophytes and mangrove species were excluded from the list. To avoid possible duplication, specimens identified to generic level were only included if no other plants from that genus were represented. Plant families are arranged alphabetically under the headings of Pteridophyta (Ferns and fern allies) followed by Angiospermae (Flowering plants). Exotic species are indicated by an asterisk (*).

Results

Grass layer composition

The dense mid-storey community currently surrounding Goose Lagoon was described by Sivertsen *et al.* (1980) as having a grass layer dominated by *Aristida* sp. This area is now dominated by *Eriachne triseta*, and *Aristida* sp. is uncommon both within this vegetation type and within the TWP generally. Descriptions of open eucalypt woodlands by Sivertsen *et al.* (1980) often note that the grass layer is dominated by *Sarga intrans.* This species now has a very low abundance within the Park, but is very common immediately adjacent to the TWP.

Species list

The list (Table 1) contains a total of 242 grass layer species, represented by 56 plant families and 145 genera. Half of the families (28) contain only one species. Not included in the list are 19 species from the author's records and 11 species from Sivertsen *et al.* (1980) which are identified to generic level only. The Poaceae contain the highest number of species (57), followed by the Cyperaceae and Fabaceae (29 and 21 species respectively). The genus with the most species is *Fimbristylis* (12 spp., Cyperaceae), followed by *Eriachne* (8 spp., Poaceae), and *Ipomoea* (7 spp., Convolvulaceae). Forbs are the most common life-form with 117 species, followed by the grasses (57 species), vines (32 species), sedges (30 species), and ferns (6 species). Exotic species comprise 5.4% of the flora (13 species).

Discussion

Grass layer composition

Changes to the grass layer species composition of the north-western corner of the TWP could be a result of the land-use history of the Park in the last two decades. Firstly, most of the north-western area has experienced just one fire since the Park opened in 1989 (Green Corps 2003), a much lower fire frequency than for other tropical savanna sites in the Top End which are typically burnt every 1-3 years (Russell-Smith *et al.* 1997, Edwards *et al.* 2001). As fire exclusion promotes the growth of woody seedlings, it contributes to increased shading and litter production, thereby leading to different microsites which may not suit the recruitment of existing species (Vazquez-Yanes & Orozeo-Segovia 1993, Woinarski *et al.* 2004).

Secondly, the TWP is surrounded by a 3 m high predator-exclusion fence which has prevented the movement of wallabies, both in and out of the TWP, and has also excluded cattle. The interaction between herbivores and the grass layer can be profound, affecting grass fuel loads, the flammability of the landscape, and the growth and mortality of seedlings (Werner *et al.* 2006). Isolating the specific factor(s) which have shaped the current composition of the grass layer at the TWP will require a thorough investigation of site history, and direct experimentation with fire and herbivory.

Species list

The number of grass layer plant species listed in Table 1 represents approximately 5% of the flora recorded in the Northern Territory (Cowie & Albrecht 2005). The number of grass layer species at the TWP is approximately three times that detected at

Solar Village in 2002, 15 km to the north-east (Woinarski, unpubl.). Such differences could simply reflect a higher sampling intensity at the TWP. The proportion of forb, grass, vine and fern species is similar between the TWP and Solar Village, although sedges represent a higher proportion of the flora in the TWP (Woinarski, unpubl.). The TWP may contain a greater area of poorly drained soils (e.g. in the vicinity of Goose Lagoon), which may favour such species.

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Table 1. Species list of vascular plants found within the grass layer of the Territory Wildlife Park. Life-form classifications follow Brennan (1996): G - grass, SE - sedge, FO - forb, VN - vine, F - fern, SH - shrub. Plant families are arranged alphabetically under the headings of Pteridophyta (Ferns and fern allies) and Angiospermae (Flowering plants). Exotic species are indicated by an asterisk (*). Data provided by: ^aSivertsen *et al.* (1980), ^bGreen Corps (2003), ^cScott (unpubl.), ^dSchatz (unpubl.).

Life-form	ASCLEPIADACEAE	
	Gymnanthera oblonga ^d	VN
	Marsdenia connivens ^b	VN
F	Marsdenia glandulifera ^b	VN
	Marsdenia velutina ^b	VN
F	Marsdenia viridiflora ^d	VN
	ASTERACEAE	
F	Allopterigeron filifolius ^b	FO
F	*Bidens bipinnata ^b	FO
	Blumea integrifolia ^c	FO
F	Blumea saxatilis ^{b. c}	FO
	Cyanthillium cinereum ^b	FO
F	Elephantopus scaber ^b	FO
	Pluchea indica ⁵	FO/SH
	*Tridax procumbens ^b	FO
FO/SH	BORAGINACEAE	
VN	Heliotropium ventricosum ^{b, c}	FO
	CAESALPINIACEAE	
FO	Chamaecrista nomame ^b	FO
	CAMPANULACEAE	
FO	Sphenoclea zeylanica ^b	FO
	CAPPARACEAE	
VN	Capparis sepiaria ^b	VN/SH
	CAROPHYLLACEAE	
FO	Polycarpaea holtzei ^b	FO
FO	Polycarpaea violacea ^b	FO
	Life-form F F F F F F F F F O/SH VN FO FO VN FO FO FO FO	Life-formASCLEPIADACEAEGymnanthera oblongadMarsdenia connivensbFMarsdenia glanduliferabMarsdenia velutinabFMarsdenia viridifloradFMarsdenia viridifloradFASTERACEAEFAllopterigeron filifoliusbFBlumea integrifoliacFBlumea saxatilisb.cCyanthillium cinereumbFElephantopus scaberbPluchea indicab*Tridax procumbensbFO/SHBORAGINACEAEVNHeliotropium ventricosumb.cCAESALPINIACEAEFOChamaecrista nomamebCAMPANULACEAEFOSphenoclea zeylanicabCAROPHYLLACEAEFOPolycarpaea holtzetbFOPolycarpaea violaceab

Territory Wildlife Park Flora

CLUSIACEAE		Fimbristylis microcarya ^b	SE
Hypericum gramineum ^b	FO	Fimbristylis oxystachya ^b	SE
COLCHICACEAE		Fimbristylis pilifera ^c	SE
Iphigenia indica ^b	FO	Fimbristylis sp. Charles Darwin	
COMMELINACEAE		(J.L. Egan 5300)°	SE
Cartonema parviflorum ^b	FO	Fimbristylis tetragona ^b	SE
Cartonema spicatum ^b	FO	Fuirena ciliaris°	SE
CONVOLVULACEAE		Lipocarpha microcephala ^{b, c}	SE
Cressa cretica ^b	FO	Rhyncospora longisetis ^b	SE
Evolvulus alsinoides ^c	FO	Schoenus falcatus ^b	SE
lpomoea abrupta ^d	VN	Scleria lithosperma ^b	SE
Ipomoea coptica ^b	VN	Scleria novae-hollandiae ^b	SE
Ipomoea eriocarpa ^c	VN	Scleria psilorrhiza ^b	SE
Ipomoea gracilis ^c	VN	Scleria pygmaea ^b	SE
lpomoea graminea ^c	VN	Scleria rugosa ^b	SE
Ipomoea lonchophylla ^d	FO	Scleria sp. McMinns Lagoon	05
lpomoea polymorpha ^b	FO		SE
Jacquemontia browniana ^b	FO/SH		Follow
Merremia dissecta ^b	VN	Pacnynema dilatatum	FO/SH
Merremia quinata ^b	VN	DROSERACEAE	50
Polymeria pusilla ^b	FO		FO
Xenostegia tridentata ^{b, c}	VN		FO
CYPERACEAE		ERIOCAULACEAE	50
Bulbostylis barbata ^c	SE	Eriocaulon cinereum	FO
Crosslandia setifolia ^b	SE	Eflocaulon setaceum	FO
Cyperus castaneus ^{b, c}	SE	Eriocaulon shultzir	FO
Cyperus digitatus ^b	SE	EUPHORBIACEAE	
Cyperus haspan ^b	SE	"Euphorbia hirta"	FO
Cyperus javanicus ^b	SE	Euphorbia schultzir	FO
Eleocharis sp. Coonjimba		Phyllanthus exilis"	FO
Billabong (T.S. Henshall 3365) ^b	SE	Phyllanthus minutiflorus"	FO
Fimbristylis acicularis ^b	SE	Phyllanthus sulcatus	FO
Fimbristylis cymosa ^b	SE	Phyllanthus urinana"	FO
Fimbristylis densa ^{b. c}	SE	Sauropus paucifolius"	FO
Fimbristylis denudata ^b	SE	Sauropus stenocladus	FO
Fimbristylis ferruginea ^b	SE	Sebastiania chamaeleaº	FO/SH
Fimbristylis littoralis ^b	SE	FABACEAE	
Fimbristylis macassarensis ^b	SE	Abrus precatorius [®]	VN

FABACEAE continued	
Alysicarpus brownii ^b	FO
Alysicarpus schomburgkii ^{b, c}	FO
Canavalia papuana ^b	VN
Chaemachrista mimosoides ^c	FO
Crotalaria brevis ^c	FO
Crotalaria goreensis ^b	FO
Crotalaria medicaginea ^c	FO
Crotalaria montana ^d	FO
Crotalaria trifoliastrum [®]	FO
Cyclocarpa stellaris ^b	FO
Desmodium brownii ^c	FO
Dunbaria singuliflora ^c	VN
Eriosema chinense ^{b.c}	FO
Flemingia parviflora ^d	FO
Galactia muelleri ^d	FO
*Macroptilium lathyroides ^b	FO
*Stylosanthes scabra ^b	FO/SI
Tephrosia remotiflora ^{c, d}	FO
Vigna vexillata ^c	VN
Zornia prostrata ^b	VN
FLAGELLARIACEAE	
Flagellaria indica ^b	VN
GOODENIACEAE	
Goodenia armstronglana ^{a, b, c}	FO
Goodenia byrnesii ^d	FO
Goodenia purpurascens ^b	FO
HAEMODORACEAE	
Haemodorum sp.	FO
HALORAGACEAE	
Gonocarpus leptothecus ^c	FO/SI
HYPOXIDACEAE	
Hypoxis nervosa ^b	FO
LAMIACEAE	
*Hyptis suaveolens ^{a, b}	• FO
LAURACEAE	4
Cassytha filiformis ^d	VN

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LENTIBULARIACEAE	
Utricularia chrysantha ^b	FO
Utricularia lasiocaulis ^b	FO
Utricularia odorata ^b	FO
LILIACEAE	
Protasparagus racemosus ^b	VN
Sowerbaea alliacea ^b	FO
Thysanotus chinensis ^b	FO
LOGANIACEAE	
Mitrasacme aggregata ^{b, c}	FO
Mitrasacme connata ^b	FO
Mitrasacme exserta ^b	FO
Mitrasacme multicaulis ^b	FO
Mitrasacme subvolubilis ^b	FO
MALVACEAE	
Abelmoschus moschatus ^b	FO/SH
MENISPERMACEAE	
Stephania japonica ^b	VN
Tinospora smilacina ^b	VN
NAJADACEAE	
Najas tenuifolia ^b	FO
ONAGRACEAE	
Ludwigia hyssopifolia ^b	FO
OPILIACEAE	
Opilia amentacea ^b	VN/SH
PASSIFLORACEAE	
Adenia heterophylla ^d	VN
*Passiflora foetida ^d	VN
POACEAE	
Alloteropsis semialata ^{a, c}	G
*Andropogon gayanus ^c	G
Anstida holathera ^b	G
Aristida hygrometrica ^{a. c}	G
Aristida pruinosa [®]	G
Bothriochloa bladhif	G
Chrysopogon fallax ^{a, c}	G
Chrysopogon latifolius ^a	G
Digitaria gibbosa ^c	G

POACEAE continued		Sarga stipoidium ^a	G
Digitaria violaescens ^c	G	Schizachyrium fragile ^{a, c}	G
Dimeria acinaciformis ^b	G	Schizachyrium pachyarthron ^c	G
Dimeria ornithopoda ^b	G	Sehima nervosumª	G
Ectrosia agrostoides ^c	G	Setaria apiculata ^{a, b, c}	G
Ectrosia leporinaª	G	Sporobolus pulchellus ^c	G
Ectrosia scabridaª	G	Thaumastochloa major ^{a. b, c}	G
Eragrostis cumingii ^{o, c}	G	Themeda arguens ^b	G
Eragrostis pubescens ^b	G	Themeda triandraª. c	G
Eragrostis rigidiuscula ^b	G	Triodia bitextura ^{a, b, c}	G
Eriachne agrostidea ^{b, c}	G	Urochloa holosericea ^c	G
Eriachne avenacea ^{a, c}	G	Whiteochloa sp. ^c	G
Eriachne burkittii ^{a, c}	G	Xerochloa imberbis ^{a, b}	G
Eriachne ciliata ^{b, c}	G	POLYGALACEAE	
Eriachne schultziana ^a	G	Polygala eriocephala ^b	FO
Eriachne squarrosa ^a	G	Polygala linearifolia ^c	FO
Eriachne stipacea ^c	G	Polygala longifolia ^b	FO
Eriachne triseta ^{a, b, c}	G	Polygala orbicularis ^c	FO
Germania grandiflora ^a	G	Polygala pycnophylla ^c	FO
Heterachne abortiva ^b	G	Polygala sp. Kakadu (L.A.	
Heteropogon contortusª	G	Craven 5464)°	FO
Heteropogon triticeus ^{a, c}	G	PORTULACACEAE	
Imperata cylindrica ^{a. c}	G	Calandrinia gracilis	FO
*Melinus repens ^c	G	Calandrinia uniflora [®]	FO
Mnesithea formosa ^c	G	RESTIONACEAE	
Mnesithea rottboellioides ^{a, b, c}	G	Dapsilanthus spathaceus°	SE
Panicum decompositumª	G	RUBIACEAE	
Panicum mindanaense ^{b, c}	G	Kailarsenia suffruticosa°	FO
Panicum trachyrhachis ^a	G	Knoxia stricta	FO
Paspalum scrobiculatum ^{a, b}	G	*Mitracarpus hirtus ^{b, c}	FO
*Pennisetum pedicellatum ^{a, b, c}	G	Oldenlandia galioides ^{6, c}	FO
*Pennisetum polystachlon ^c	G	Spermacoce articularis [®]	FO
Perotis rara ^b	G	Spermacoce auriculata [®]	FO
Pseudopogonatherum	G	Spermacoce calliantha®	FO
Secolatopia indica ^{b, c}	C	Spermacoce stepophylic ^b	FO
Satciolepis Indica	G		10
Sarga niurans	G	Buchners are silleb	FO
Sarga plumosum	G	Buchnera gracilis	-0

SCROPHULARIACEAE cont.		Melochia corchorifolia ^b	FO/SH
Buchnera linearis ^c	FO	Waltheria indica ^{b.c}	FO/SH
Buchnera tetragona ^b	FO	STYLIDIACEAE	
Buchnera urticifolia ^c	FO	Stylidium capillare ^b	FO
Centranthera cochinchinensis ^b	FO	Stylidium fissilobum ^b	FO
Limnophila fragrans ^{b, c}	FO	Stylidium schizanthum ^b	FO
Lindemia sp. Mount Bundey (C.R. Dunlop 8840) ^b	FO	Stylidium semipartitum ^c	FO
*Scoparia dulcis ^c	FO	Clerodendrum inerme ^b	VN/SH
Stemodia lythrifolia ^{a. c}	FO/SH	Clerodendrum tatel ^c	FO
SMILACACEAE		Huyleva linifolia ^b	FO
Smilax australis	VN	VITACEAE	10
STACKHOUSIACEAE		Ampelocissus acetosa ^b	VN
Stackhousia intermedia ^c	FO	XYRIDACEAE	
STERCULIACEAE		Xvris complanata ^c	FO
Helicteres sp. Darwin (S.T. Blake 16793) ^c	FO	Xyris pauciflora ^b	FO



One of many grasses at the Territory Wildlife Park, Northern Canegrass Mnesithea rottboellioides. (Ken Scott)